

TABLE OF CONTENT

CHAPTER	TITLE	PAGE
	SUPERVISOR'S DECLARATION	i
	DECLARATION	ii
	DEDICATION	iii
	ACKNOWLEDGMENT	iv
	ABSTRACT	v
	TABLE OF CONTENT	vi
	LIST OF FIGURE	x
	LIST OF TABLE	xiii
	LIST OF APPENDIXES	xiii
1	INTRODUCTION	1
1.1	Background	1
1.2	Issue	3
1.3	Problem statement	4
1.4	Objectives of study	5
1.5	Scope of study	5
1.6	Significance of study	6

1.7	Methodology	6
1.8	Thesis structure	6
2	LITERATURE REVIEW	7
2.1	Introduction	7
2.2	Definition of Expansive soil	7
2.3	Expansive soil in Indonesia	8
2.4	The characteristics of damage roads on expansive soil	10
2.5	Degree of Expansion	10
2.6	Active Zone	10
2.7	Basic Approaches to Construct Road in Expansive soil	12
2.8	History of value engineering	14
2.9	Definition of value engineering	15
2.10	Value Engineering Methodology in construction work	16
2.10.1	Information phase	16
2.10.2	Function Analysis Phase	17
2.10.2.1	Determine the Function	17
2.10.2.2	Classify the function	18
2.10.2.3	Function Relationship	19
2.10.3	Speculative phase	20
2.10.4	Evaluation phase	21

2.10.5	Development phase	23
2.11	Value Engineering benefit in construction works	24
2.12	Summary	25
3	RESEARCH METHODOLOGY	26
3.1	Research methodology	26
3.2	Literature study and data collection	27
3.3	Case study	27
3.4	Value engineering in road construction at expansive soil	27
4	VALUE ENGINEERING AND DISCUSSION	29
4.1	Introduction	29
4.2	Information phase	29
4.2.1	Soil Classification	30
4.2.2	Degree of Expansion	31
4.2.3	Active Zone	33
4.2.4	Design objective	34
4.2.5	Information phase discussion	34
4.3	Function analysis phase	35
4.3.1	Determine the function	35
4.3.2	Classify the Function	37
4.3.3	Function Relationship	38

4.3.4	Function analysis phase discussion	39
4.4	Speculative phase	39
4.4.1	Speculative phase on Case 1 and Case 2	40
4.4.2	Speculative phase discussion	44
4.5	Evaluation phase	45
4.5.1	Evaluation phase on Case 1	45
4.5.2	Evaluation phase on Case 2	50
4.5.3	Evaluation phase discussion	55
4.6	Development phase	57
4.6.1	Development phase on case 1	57
4.6.2	Development phase on case 2	60
4.6.3	Development phase discussion	63
4.7	Summary	63
5	CONCLUSION AND RECOMMENDATION	65
5.1	Conclusion	65
5.2	Study limitation	67
5.3	Recommendations	67
	REFERENCES	68
	APPENDIX A	68

LIST OF FIGURE

FIGURE NO.	TITLE	PAGE
1.1	Spread of Expansive soil in Indonesia	2
2.1	Spread of expansive soil in Java	9
2.2	Method for determinant active zone from water contain changing (Nelson & Miller, 1992)	11
2.3	Horizontal membrane in Road construction	13
2.4	Vertical membrane in Road construction	13
2.5	Fundamentals of FAST Diagramming (WVDOH, 2004).	20
2.6	Example Criteria Weighting Process for Exterior wall (dell'isola,1982)	22
2.7	Example Criteria Weighting Process for Exterior wall (dell'isola,1982)	23
3.1	Research methodology	26
4.1	Location of the project	30
4.2	Plasticity chart of Semarang-Godong and Purwodadi-Wirosari test data	31

4.3	Van der Merwe chart of Semarang-Godong and Purwodadi-Wirosari test data	32
4.4	Chen (1965) chart of Semarang-Godong and Purwodadi-Wirosari test data	32
4.5	Seed, Et. Al (1962) chart of Semarang-Godong and Purwodadi-Wirosari test data	33
4.6	Guideline for information phase	35
4.7	Typical damage pavement at expansive soil will reduce performance	36
4.8	Technical FAST Diagram for road construction at expansive soil	38
4.9	Replace material on case 1	40
4.10	Replace material on case 2	41
4.11	Typical design using membrane Horizontal in case 1	41
4.12	Typical design using membrane Horizontal in case 2	42
4.13	Typical design using membrane Vertical with backfill compacted in case 1	42
4.14	Typical design using membrane Vertical with backfill compacted in case 2	43
4.15	Typical design using membrane Vertical with cement slurry in case 1	43
4.16	Typical design using membrane Vertical with cement slurry in case 2	43
4.17	Cost estimation for Increase performance function on Case 1	47

4.18	Time Construction estimation for Increase performance function on Case 1	48
4.19	Criteria weighting process Road construction at expansive soil on Case 1	49
4.20	Analysis matrix Road construction at expansive soil on Case 1	50
4.21	Cost estimation for Increase performance function on Case 2	52
4.22	Time Construction estimation for Increase performance function on Case 2	52
4.23	Criteria weighting process Road construction at expansive soil on Case 2	54
4.24	Analysis matrix Road construction at expansive soil on Case 1	55
4.25	Flow evaluation phase for road construction in expansive soil	56
4.26	Cost Comparison membrane vertical with backfill v other alternative on case 1.	58
4.27	Membrane vertical on Texas Highway Project	59
4.28	Time Construction comparison membrane horizontal with other alternative on case 1	60
4.29	Cost Comparison membrane vertical with backfill v other alternative on case 2.	61
4.30	Time Construction comparison membrane vertical with cement slurry v other alternative on case 2	62

LIST OF TABLE

TABLE NO.	TITLE	PAGE
2-1	Job Plan Value Engineering (WSDOT, 2009)	16
2-2	list of Idea for repair old railway embankment (Jesper,2010)	21
3-1	Value engineering for road construction in expansive soil	28
4-1	Depth of Active Zone	33
4-2	Component and function	37
4-3	Classification the function	37
4-4	Output of Speculative phase	44
4-5	Cost Estimation Comparison on Case 1	46
4-6	weight criteria of ideas for Cost and time Construction on case 1	48
4-7	Cost Estimation Comparison on Case 2	51
4-8	weight criteria of ideas for Cost and time Construction on case 2	53
4-9	Output of evaluation phase	57

LIST OF APPENDIXES

APPENDIXES NO.	TITLE	PAGE
A.1	Value Engineering Member	71
A.2	Schedule Value Engineering Simulation	71